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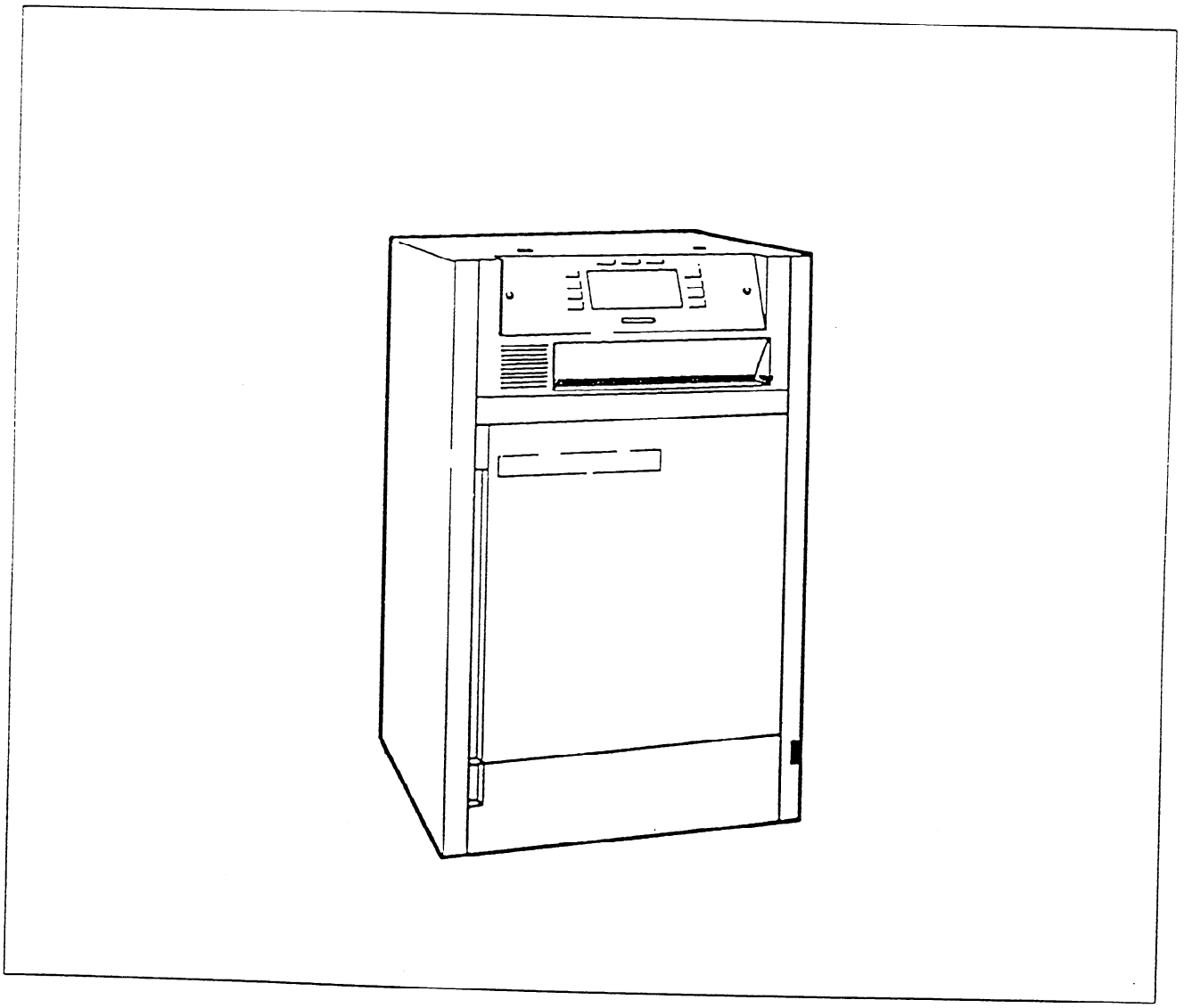
THEORY GUIDE

for the

Kodak

Multiloader 700



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1. SYSTEM OVERVIEW

The ML 700 contains the following basic systems:

1. MECHANICAL SYSTEM
2. ELECTROMECHANICAL SYSTEM
3. ELECTRONIC SYSTEM

The mechanical system is devided into the following subsystems:

1. FRAME
2. MAGAZINE HOLDER
3. MAGAZINE OPENER
4. FILM POCKET
5. CASSETTE TRANSPORT
6. CASSETTE CENTERING
7. CASSETTE OPENER
8. CASSETTE UNLOAD MECHANISM
9. FILM TRANSPORT
10. TUNNEL (INTERFACE ML700 to PROCESSOR)
11. DOOR

The electromechanical system consists of:

1. COMPRESSOR SYSTEM
2. VACUUM SYSTEM
3. MOTORS
4. FANS
5. SENSORS

The electronic system consists of:

1. KEYBOARD + DISPLAY
2. MASTER PROCESSOR
3. SLAVE PROCESSOR
4. DRIVER PCB
5. SENSOR PCB'S WITH INTERFACE PCB'S
6. POWER SUPPLY
7. PRINTER
8. SOFTWARE

2. MECHANICAL SYSTEM

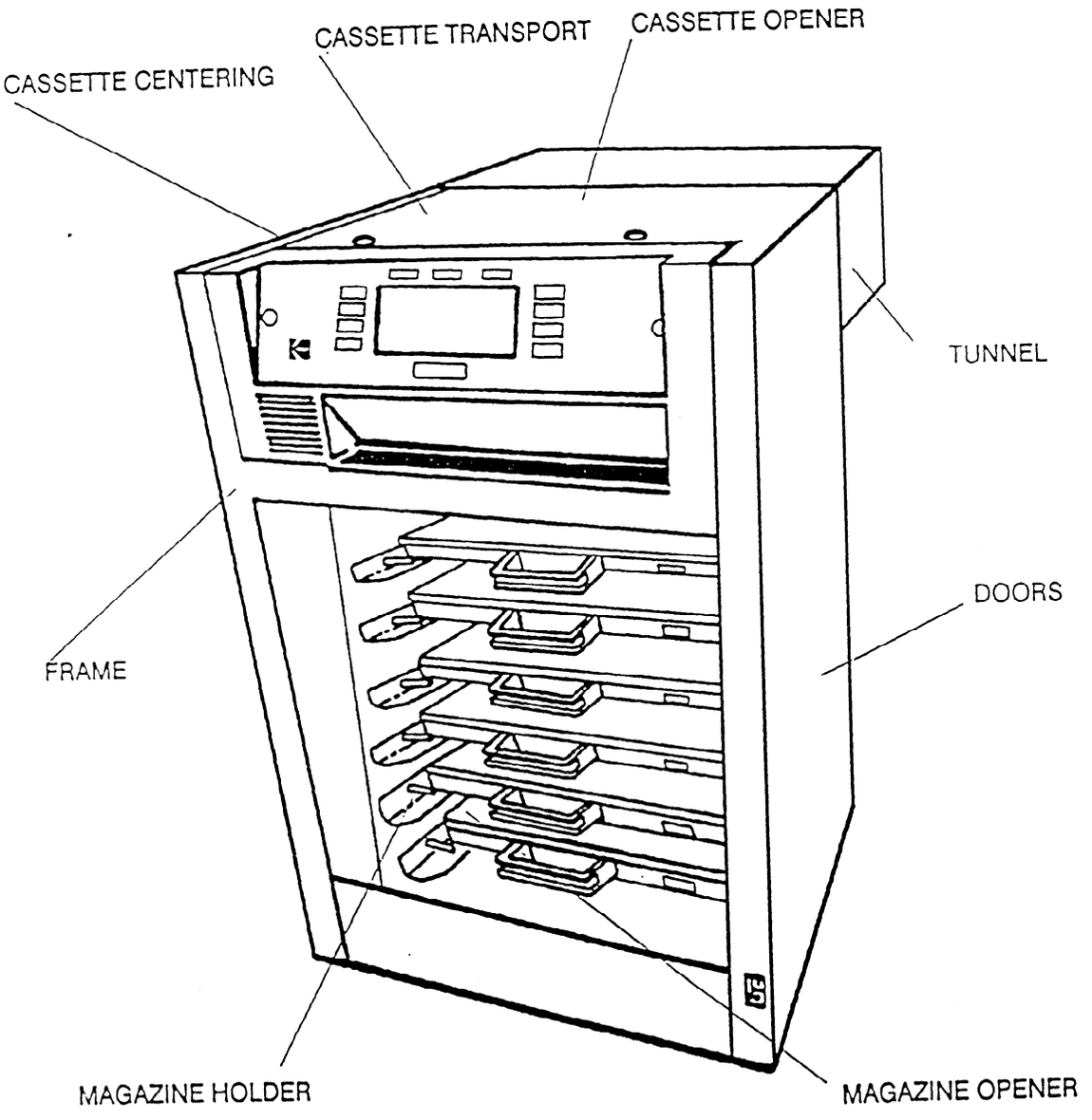

figure1

2.1 FRAME

All parts or group of parts are mounted to the FRAME. The rear posts are used as a reference for CASSETTE TRANSPORT and the MAGAZINE HOLDERS. The FRAME is supported by three leveling feet.

2.2 MAGAZINE HOLDER

The MAGAZINE HOLDER accepts up to seven MAGAZINES. All MAGAZINES are basically the same. They are set to the various film sizes. At the rear every MAGAZINE is coded for the correct film size. At the rear of the MAGAZINE HOLDER are 7 PCB's to read the corresponding film size. At the front (left and right side) are two ROLLERS. They are adjustable, so that each MAGAZINE will be seated correctly.

2.3 MAGAZINE OPENER

The OPENER BAR carries seven SOLENOIDS. Only one SOLENOID is activated at a time. Then the MAGAZINE OPENER MOTOR moves up the OPENER BAR. Just the selected MAGAZINE will be opened. To close the MAGAZINE the SOLENOID is deenergized and the OPENER BAR moves down.

2.4 FILM POCKET

The FILM POCKET is mounted to an ELEVATOR system. A STEPPER MOTOR drives a CHAIN and the ELEVATOR moves up and down. The FILM POCKET itself has a MOTOR too. This MOTOR moves the SUCKER BAR in and out of a MAGAZINE or CASSETTE. The SUCKER BAR has a tilted (Whitney) and a horizontal position. To pick up a FILM it has to be horizontal; then it is brought into the tilted position. The FILM is now transported into the FILM POCKET.

a) MAGAZINE SUCKER BAR IN = SUCKER BAR is in the MAGAZINE/CASSETTE.

b) TRANSPORT POSITION 1 = SUCKER BAR is just out of the MAGAZINE/CASSETTE so that the FILM POCKET may move up or down without interfering with the MAGAZINES.

c) TRANSPORT POSITION = SUCKER BAR is in outermost endposition.

The function of the SENSORS are shown in topic 3.5

2.5 CASSETTE TRANSPORT

The CASSETTE is transported via a BELT up to the ENDSWITCH. The tension of the BELT is adjustable with two SCREWS. The two rear BEARINGS are SWING BEARINGS to compensate for parallelism errors.

2.6 CASSETTE CENTERING

The CASSETTE OPENER is fixed to the center. It is unlikely that the OPERATOR inserts the CASSETTE centered. Therefor every CASSETTE will be centered automatically. This is done with two CENTERING BARS. They are moved by a seperate MOTOR. Two SWITCHES detect if a CASSETTE is centered. Than the MOTOR stops. If too small a CASSETTE was entered, these SWITCHES are not actuated and the CENTERING BARS are moved to their innermost position.

2.7 CASSETTE OPENER

ENTRY DOOR closes. CASSETTE LATCH is relaxed by pressure from SPRING LOADED PINS pushing on RAIL on either side of the LATCH. The SHOVEL slides under the loosened LATCH, unlatching CASSETTE.

FILM EXIT DOOR, to which SPRING LOADED pins are attached, is raised. CASSETTE is started open by natural spring action assisted by SPRING LOADED ARMS attached to the EXIT DOOR (required for VIDEO FILM HOLDERS, MAMMOGRAPHY CASSETTES, and most 18 x 24 cm CASSETTES).

A PAWL HOOK makes positive engagement with the CASSETTE LID. The CASSETTE HOLD DOWN PAWL engaged TUBE SIDE PANEL to prevent lifting of TUBE SIDE while the CASSETTE LID is raised or while the FILM is taken by the SUCKER BAR. The LID is raised to maximum open position, with BLOW PIPES at the corners of the LID being actuated after opening is about 30 % complete. Air is directed over the FILM to release it from the UPPER SCREEN by the vacuum effect.

2.8 CASSETTE UNLOAD MECHANISM

When a CASSETTE is opened, then the ENTRY DOOR is closed and the EXIT DOOR is opened. Through this the CASSETTE SUCKERBAR moves into the CASSETTE, to the FILM. The FILM is picked up and moved out of the CASSETTE. As soon as the FILM reaches the INPUT ROLLERS vacuum is released and the FILM is transported to the TUNNEL and to the PROCESSOR.

2.9 FILM TRANSPORT

As soon as a CASSETTE is entered the FILM TRANSPORT MOTOR M5 is started. The CASSETTE is opened and when the previous FILM has left the TUNNEL the CASSETTE SUCKER BAR picks up the FILM from the CASSETTE. The FILM interrupts the INFRARED BEAM of B6 and the VACUUM OFF TIME is started. After 2 seconds the FILM is picked up by the INPUT ROLLERS and the vacuum is turned off. The Film is now guided between the UPPER and LOWER FILM GUIDE to the EXIT ROLLERS. Then the FILM enters the TUNNEL.

2.10 TUNNEL

The TUNNEL is just a mechanical interface between the ML 700 and the PROCESSOR. There are two different TUNNELS. One for the PROCESSOR M6B and M8 and one for the PROCESSOR ME3. The CONVEYORS inside the TUNNEL are almost the same. They just guide the FILM to the PROCESSOR. There are two SENSORS to detect a FILM JAM. The shafts are driven via an O-ring by the ML 700.

2.11 DOORS

FRONT DOOR gives access to the MAGAZINES. It has two electromagnetic LATCHES.

ENTRY AND EXIT DOOR of CASSETTE AREA are closed when a CASSETTE is open.

3. ELECTROMECHANICAL/PNEUMATIC SYSTEM

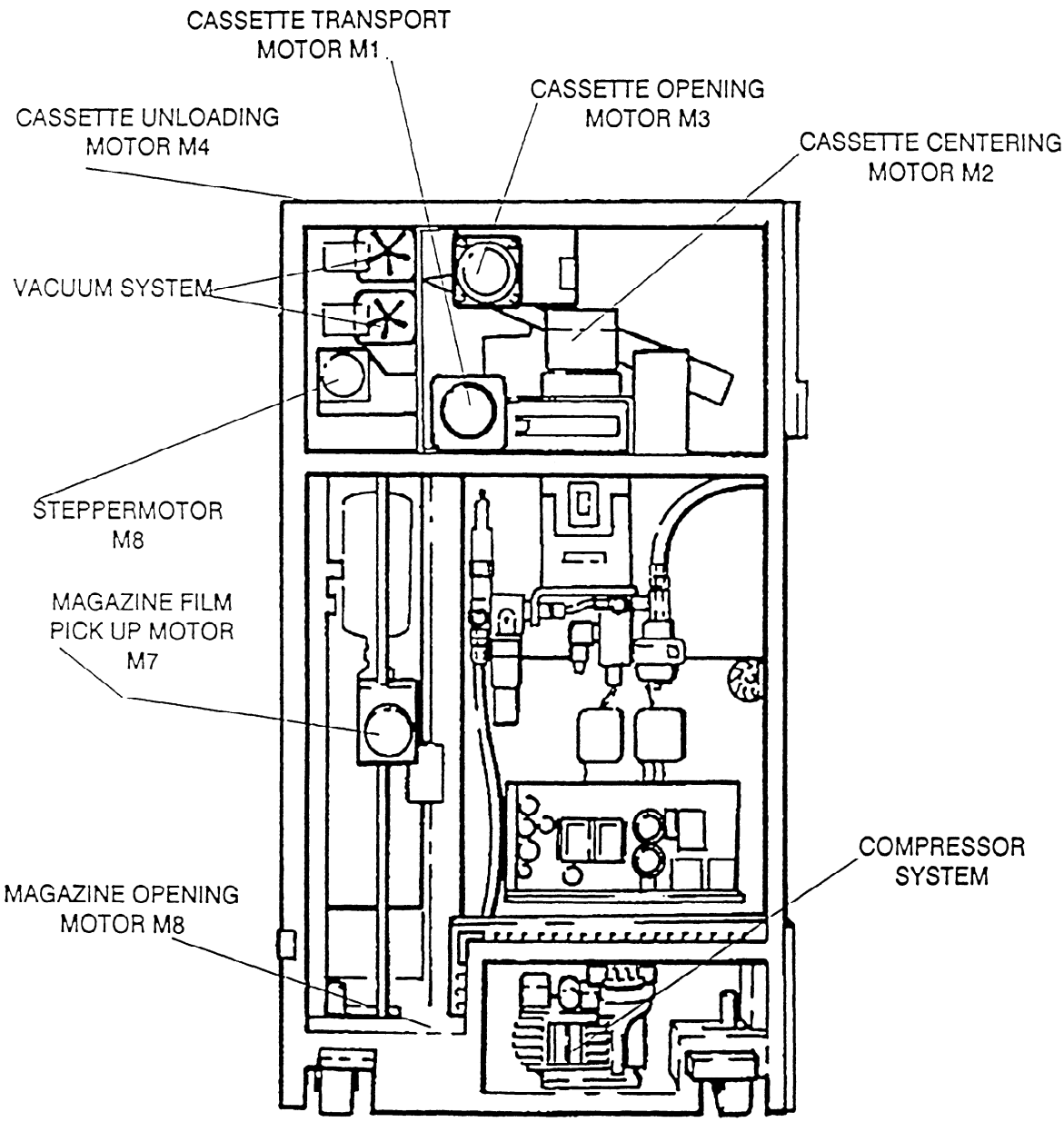

figure2

3.1 COMPRESSOR SYSTEM

On the lefthand bottom side the COMPRESSOR is installed. The COMPRESSOR gives a pressure of 4 bar. It is controlled by an AIR SWITCH. The compressed air is pumped into the AIR BOTTLE. As soon as the correct pressure is reached the PRESSURE SENSITIVE SWITCH stops the COMPRESSOR. Then the HOSE from the COMPRESSOR to the BLEEDER VALVE is vented. This is important, the COMPRESSOR cannot start again if there is pressure in this HOSE.

3.2 VACUUM SYSTEM

There are two VACUUM PUMPS. One for the CASSETTE SUCKER BAR and one for the MAGAZINE SUCKER BAR. A VACUUM SWITCH is installed in either PUMP. When a PUMP is started, it runs for a short moment. Only when a VENT is open, this means a film is picked up, the PUMP is running.

3.3 MOTORS

CASSETTE TRANSPORT MOTOR	M1	ASYNCHRON
CASSETTE OPENING MOTOR	M3	SYNCHRON
CASSETTE CENTERING MOTOR	M2	ASYNCHRON
CASSETTE UNLOADING MOTOR	M4	SYNCHRON
FILM TRANSPORT MOTOR	M5	SYNCHRON
MAGAZINE OPENING MOTOR	M6	SYNCHRON
MAGAZINE FILM PICK UP MOTOR	M7	SYNCHRON
STEPPER MOTOR	M8	

There are three different types of motors used:
- Asynchronous motors
- Synchronous motors
- Stepper motor

When a constant speed is important, synchronous motors are used. For CASSETTE TRANSPORT and CENTERING a constant speed is not important. Therefore asynchronous motors are used.
The FILM POCKET has to move over a correct distance. The STEPPERMOTOR receives a calculated amount of pulses and the FILM POCKET goes to the desired position.

3.4 FANS

Two FANS are installed. The one at the right hand bottom side cools the COMPRESSOR and the ELECTRONICS in the DRAWER. The other is mounted to the left panel. It has to maintain a positive pressure inside the ML 700 so that dust and chemical fumes do not enter the equipment.

3.5 SENSORS

3.5.1 FILM PRESENCE DETECTOR

In every cassette two REFLECTIVE STICKERS are installed. One at the bottom and one at the LID. When a CASSETTE is open, two infra-red SENSORS look into it. They recognize if one or two or no FILM is in the CASSETTE.

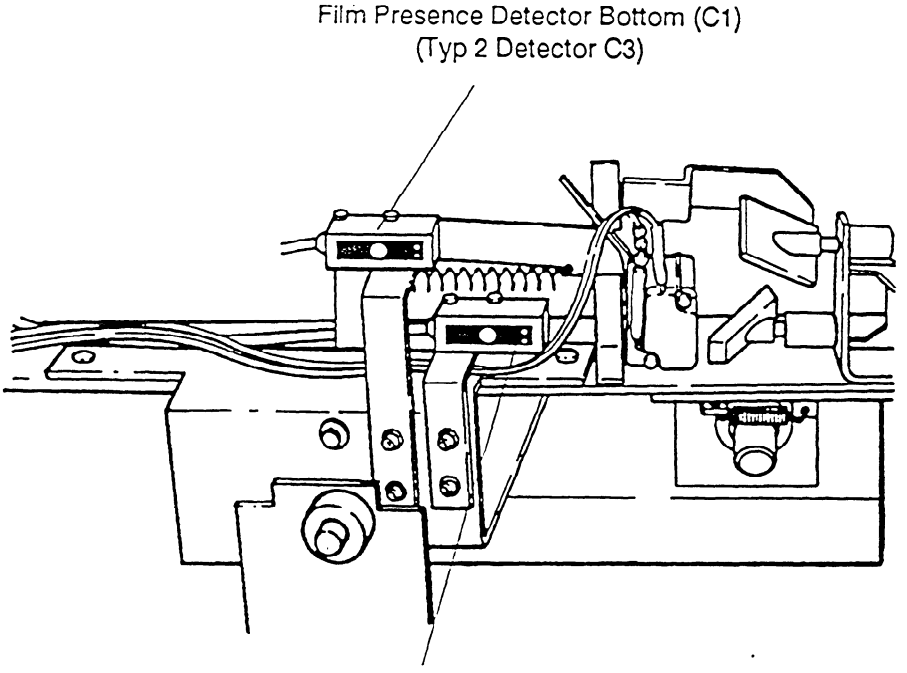

figure 3

3.5.2 FILM TYPE 2 SENSOR

Type 2 CASSETTES have an additional REFLECTIVE STICKER on the outside of the CASSETTE.

3.5.3 CASSETTE WIDTH/CASSETTE OPEN SENSORS

Three switches are mounted together on the INFEED PRESSURE ROLLER.

3.5.4 CASSETTE SIZE SENSOR

While a CASSETTE is centered a light beam of a photocell is interrupted by a slotted BAR. This BAR is mounted to the left CENTERING BAR. The output pulses of the SENSOR are counted. The number of pulses give the CASSETTE LENGTH.

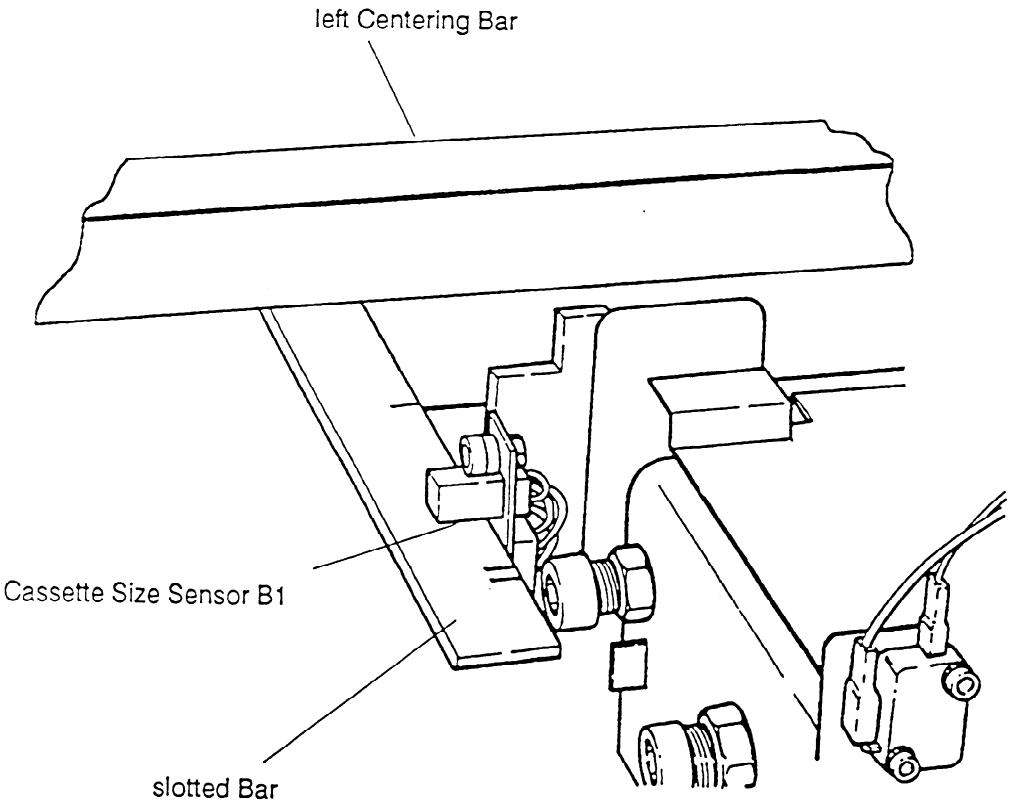

figure 4

3.5.5 MAGAZINE ALMOST EMPTY SENSOR

This SENSOR is mounted to the FILM POCKET SUCKER BAR. The SUCKER BAR moves into the MAGAZINE. If there are appr. 10 films left than the SENSOR is interrupted.

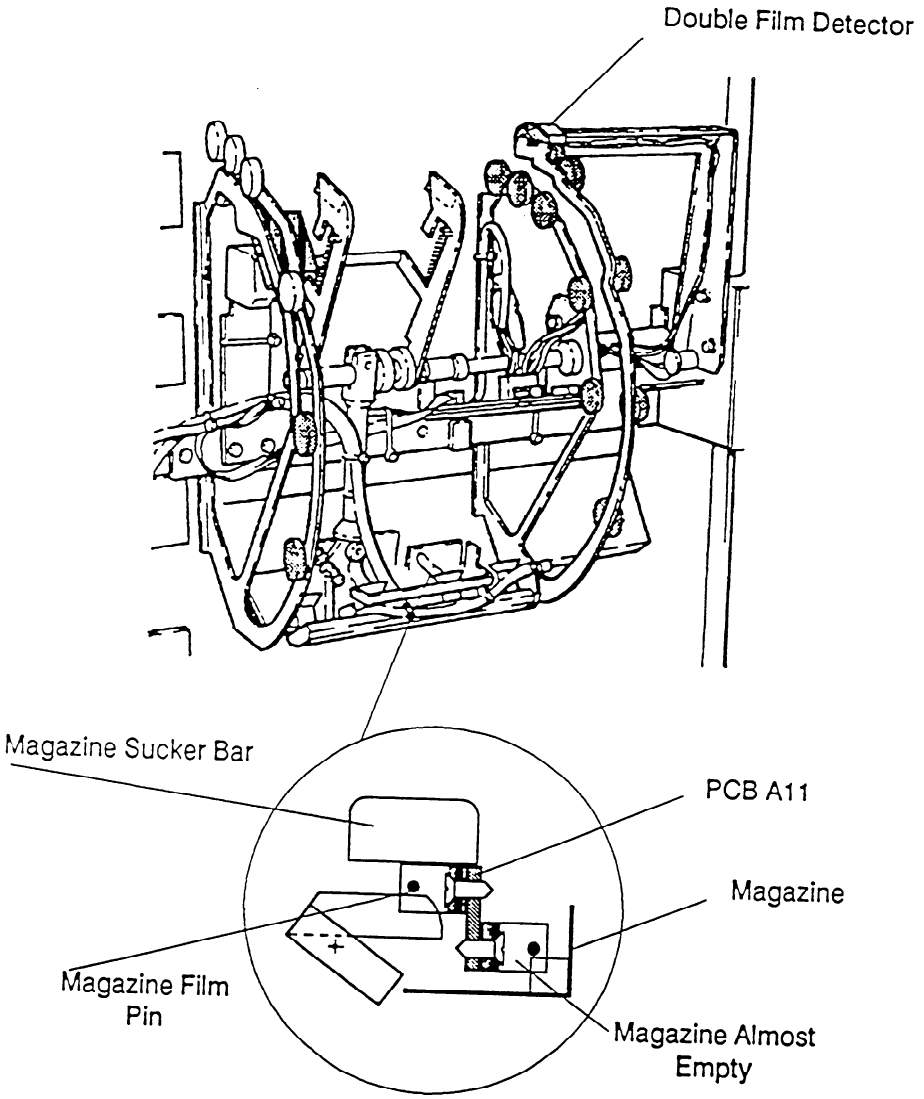

figure 5

3.5.6 MAGAZINE EMPTY SENSOR

It is a SENSOR like the FILM PRESENCE DETECTOR. There is a reflective tape inside the MAGAZINE and the INFRA-RED SENSOR looks via a mirror into the MAGAZINE. As soon as the MAGAZINE is empty this SENSOR sees its reflected light. This gives the MAGAZINE EMPTY signal.

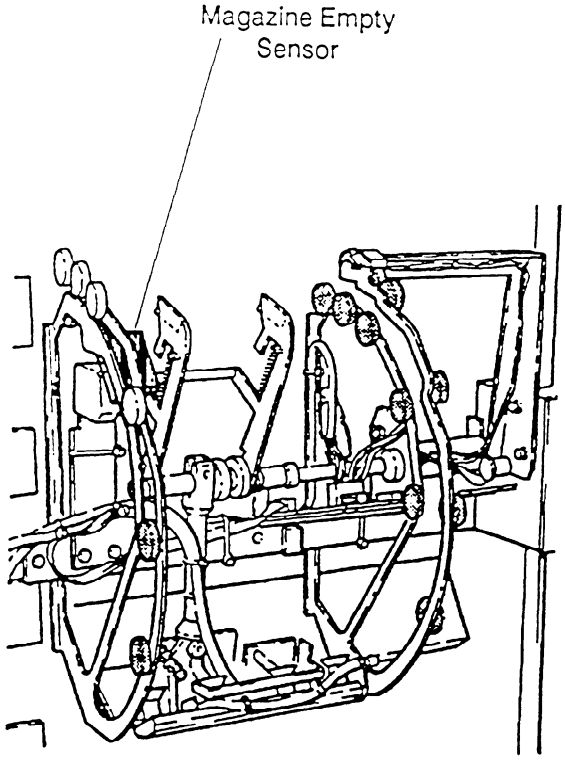

figure 6

3.5.7 DOUBLE FILM DETECTOR

The infra-red transparency of the FILM is measured.The DOUBLE FILM DETECTOR decides if one FILM or more than one FILM is in the POCKET INFRARED SENSOR.

3.5.8 FILM PIN

This INFRARED SENSOR is mounted to the FILM POCKET SUCKER BAR. It detects if the SUCKER BAR reached the FILMS in the MAGAZINE and if the FILM stays at the SUCKER BAR when transported out.(see figure 5)

3.5.9 INDUCTIVE SENSORS

Two INDUCTIVE SENSORS are looking for the metal frame of the CASSETTE. If they are triggered the transport starts. If a CASSETTE is inserted upside down the aluminium plate at the bottom of the CASSETTE could trigger the sensors. To avoid this two plastic spacers are mounted to the sensors.

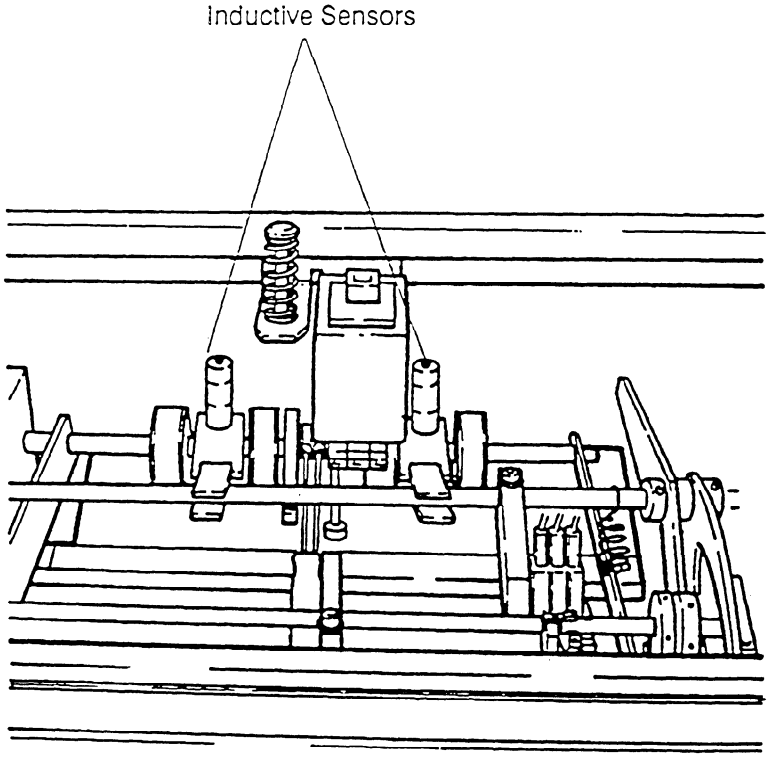

figure7

4. FUNCTIONAL DESCRIPTION OF PCB's

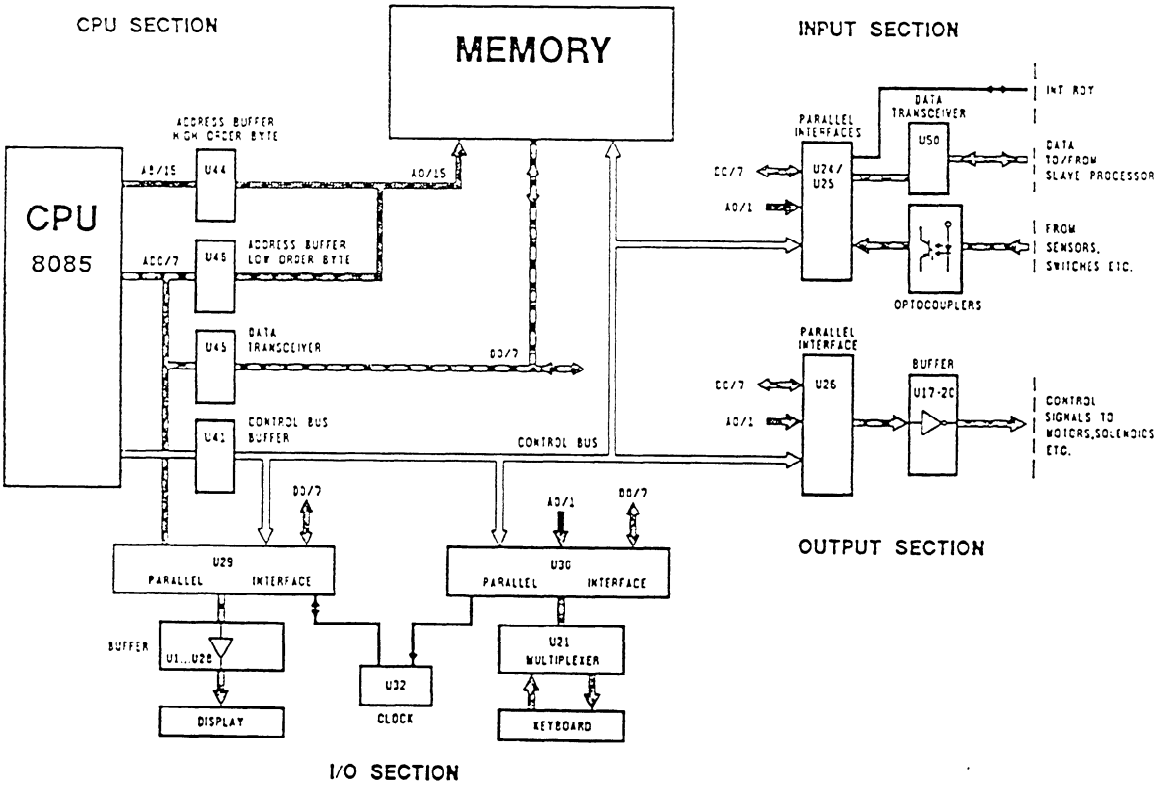

figure 8

4.1 PCB A0

The MASTER PROCESSOR contains in its memory the main program. A 8085 clocked with 6 MHz is used as CPU. The Inputs to PCB A0 are monitored by the MICRO PROCESSOR and the Outputs of PCB A0 are controlled by the MICRO PROCESSOR.

PCB A0 is split into 5 sections:

1. CPU
2. Memory
3. Input
4. Output
5. I/O

These sections are shown on the previous block diagram. If for example the CASSETTE OPEN SWITCH has to be monitored the following actions take place on PCB A0:

1. The MICRO PROCESSOR sends out an Address to select the PARALLEL INTERFACE.
2. The MICRO PROCESSOR enables the selected PARALLEL INTERFACE through the CONTROL BUS.
3. If necessary a CONTROL WORD is send through the DATA BUS to the PARALLEL INTERFACE. This CONTROL WORD sets (programms) the INTERFACE.
4. The desired input information of the PARALLEL INTERFACE is switched to the DATA BUS.
5. The MICRO PROCESSOR reads this information and starts the necessary actions.

If for example a SOLENOID has to be turned on, the following actions take place:

1. The MICRO PROCESSOR sends out an address to select the PARALLEL INTERFACE.
2. The MICRO PROCESSOR enables the selected PARALLEL INTERFACE through the CONTROL BUS.
3. If necessary a CONTROL WORD is sent through the DATA BUS to program the PARALLEL INTERFACE.
4. The DATA BUS is switched to the selected OUTPUTS of the PARALLEL INTERFACE.
5. The MICRO PROCESSOR sends out the required data.

4.2 PCB A2

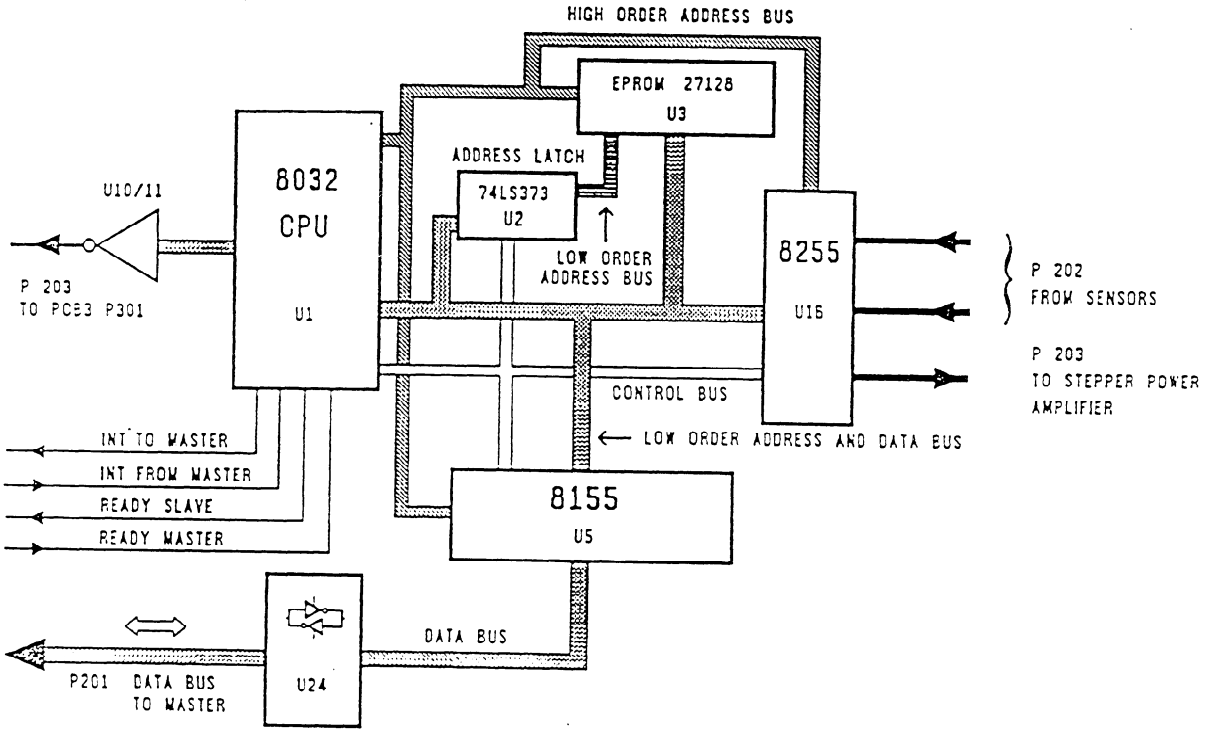

figure 9

PCB A2 contains a complete MICRO PROCESSOR System. This system is called "Slave Processor". Its task is twofold:

1. It monitors all SENSORS associated with FILM POCKET, STEPPER MOTOR, MAGAZINE open/closed

2. It controls STEPPER MOTOR FILM POCKET (e.g. various transport positions, pivot SUCKER BAR, blow air, suck air, etc.) MAGAZINE OPENER .

The SLAVE PROCESSOR works only on request. This means it is allways in a waiting loop. As soon as it receives an Interrupt from the MASTER it will read a command on the DATA BUS from the MASTER. The desired action is then started. If it has to send back an information to the MASTER (e.g. Errormessage, MAG. EMPTY, etc.) it sends first an Interrupt to the MASTER and then the necessary information is put onto the DATA BUS.

The Outputs at P203 and the Inputs at P202 are isolated with OPTO COUPLERS. Their purpose is to protect the SLAVE from electrical noise.

4.3 PCB A3

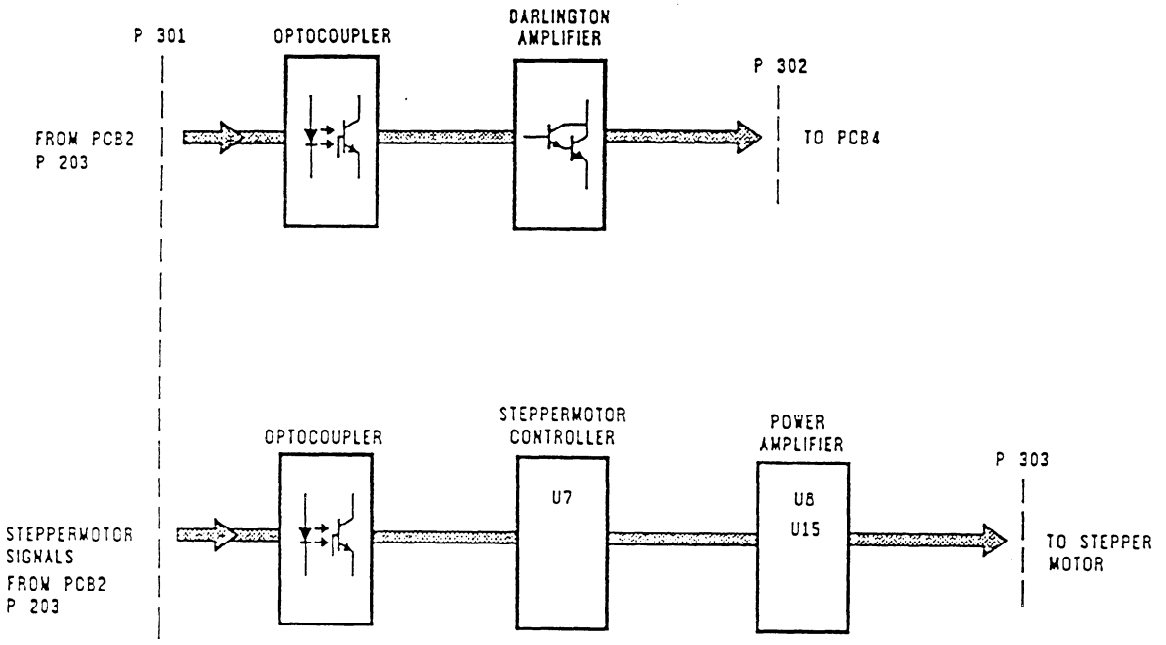

figure 10

PCB A3 is devided into two parts. The upper part is nothing more than an amplifier. The signals have to be amplified, so that they can drive the SOLID STATE RELAYS on PCB A4.

The lower part contains the STEPPER MOTOR CONTROLLER and the POWER AMPLIFIERS. Their are 4 signals from PCB2:

Direction
Step
I30 %
Enable

The Enable signal enables the Output logic of the controller. Direction is used for cw/ccw. The STEP PULSES are counted by an internal counter. The state of this counter gives the STEPPER MOTOR PULSES. I30 % is used during speed up an slow down. If the motor would be started with full power then it would loose steps. The Output of the controller drives the POWER AMPLIFIER.

4.4 PCB A4

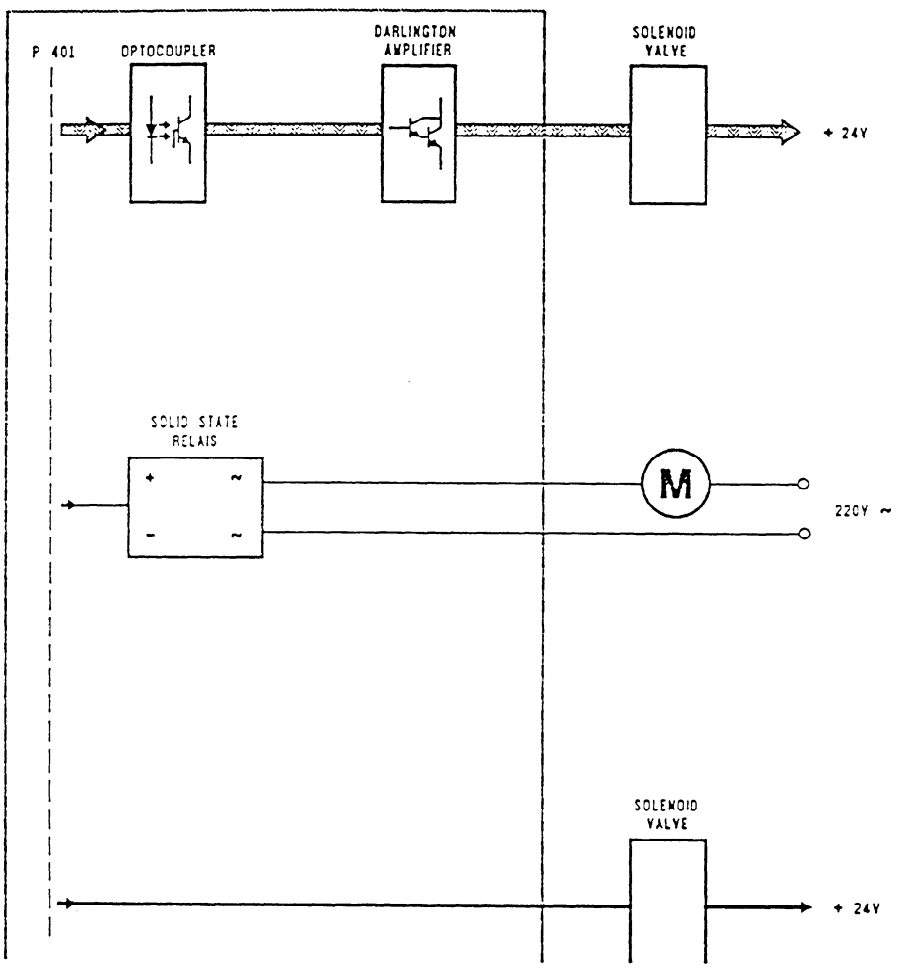

figure 11

There a 3 different groups on this board:

Group 1:The incoming logic signals cannot drive SOLENOIDS immediately. These signals have to be amplified. This is the purpose of the DARLINGTON AMPLIFIERS.

Group 2:The incoming signals control SOLID STATE RELAYS. These relays in turn drive the AC MOTORS.

Group 3:The incoming signals are strong enough to drive the SOLENOID VALVES.

4.5 PCB A5 + A6

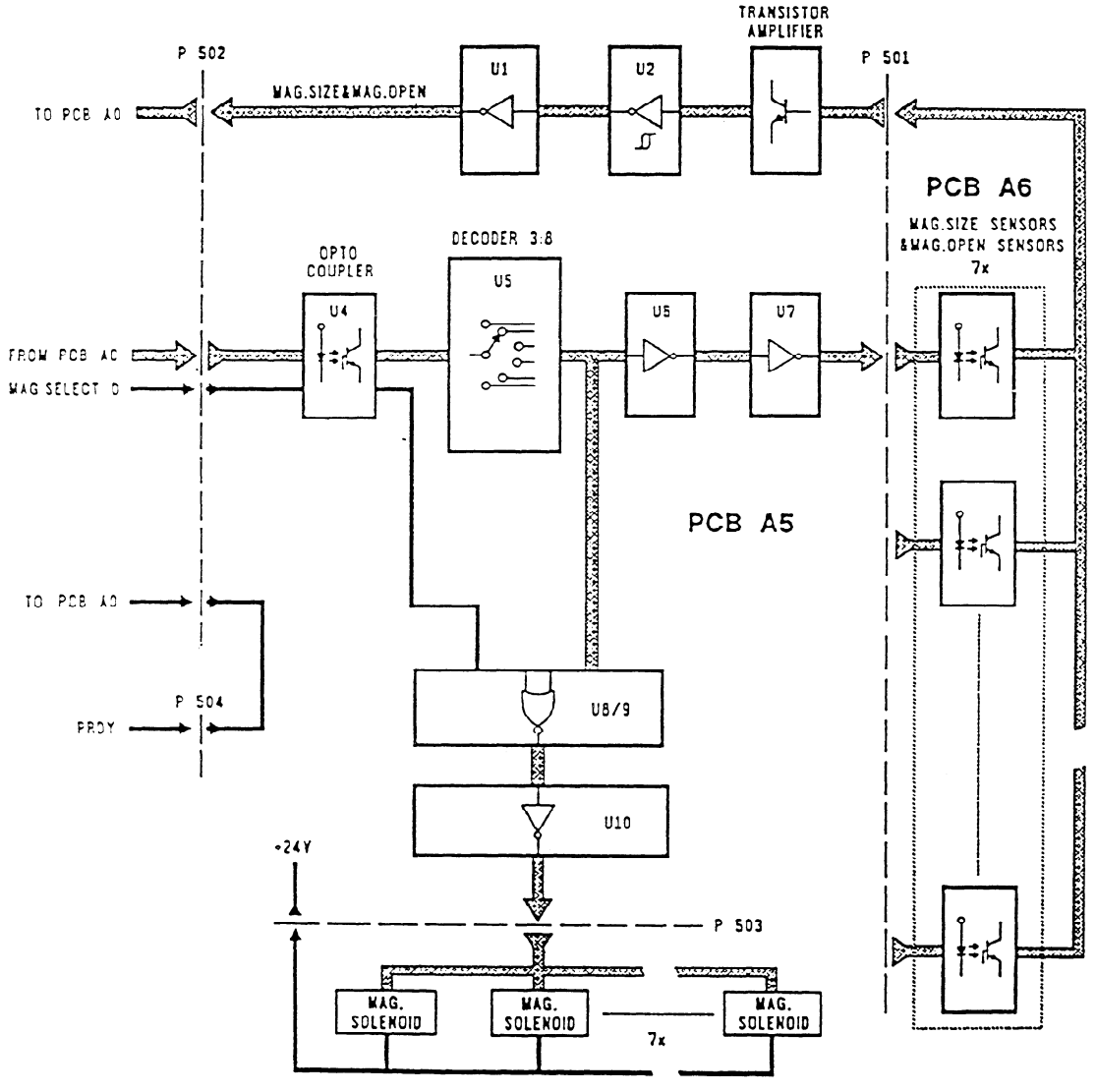

figure 12

PCB A5 und PCB A6 are used at two events:

1. FRONT DOOR was opened. In this case the programm monitors the seven MAGAZINES. The FRONT DOOR is only opened when a MAGAZINE is reloaded or replaced. Therefor the MEMORY and DISPLAY must be updated.

2. A MAGAZINE is selected. In this case the selected MAGAZINE OPENER SOLENOID is energized and the selected MAGAZINE COVER OPEN SENSOR is monitored.

The MASTER PROCESSOR sends the address information to the OPTO COUPLER (U4). The Output of this coupler is decoded by U5 and the correct PCB A6 (there are 7) is selected. In case 1 the state of all PCB A6 is read. In case 2 just one address is send out to PCB A5. In addition to the address the MAG. SELECT SIGNAL enables U9 and the selected MAG. OPENER SOLENOID is energized.

4.6 PCB A7

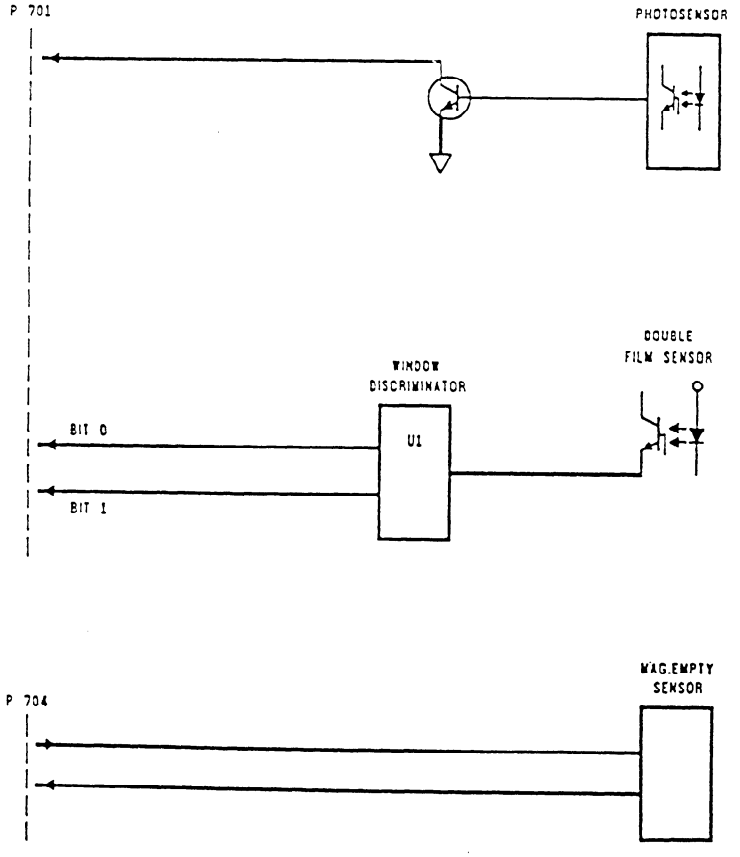

figure 13

PCB A7 contains TRANSISTOR AMPLIFIERS for SENSORS and the DOUBLE FILM DETECTOR. Three SENSORS are mounted on the PCB. They are used to detect the position of the FILM POCKET (e.g. MSI, TP1, TP). The MAGAZINE EMPTY SENSOR needs no additional amplifier, for its Output has already correct logical levels. Up To SN 1022 the DOUBLE FILM SENSOR consists out of a SENSOR and WINDOW DISCRIMINATOR. For SN 1023 and higher the WINDOW DISCRIMINATOR is replaced against on OPERATIONAL AMPLIFIER.

4.7 PCB A8

There is just one TRANSISTOR AMPLIFIER for the CASSETTE LENGTH SENSOR on this board. All the other signals are just fed through.

4.8 PCB A9

PCB A9 contains two types of sensor amplifiers. If the SENSOR monitors the presence of a film then an OpAmp is used. In this case a variation in density is measured and therefor the AMPLIFIER works as a comparator. In the other case the TRANSISTOR AMPLIFIER just work as a switch.

The TUNNEL SENSOR REAR checks if the film has left the TUNNEL. This SENSOR is not direct at the exit of the TUNNEL, therefore the signal is prolonged by an ONE SHOT (U3). For the transport speed of the processor depends on its type, the timeout of the ONE SHOT is variable. It can be set for ME3, M6 and M8.

4.9 PCB A10

On this board are the AMPLIFIERS for the SENSORS of the MAGAZINE OPENER and the SENSORS plus AMPLIFIERS for the position of the FILM POCKET (e.g. Home Position, Upper- and Lower Limit). The signals for the MAGAZINE SOLENOIDS are just fed through.

4.10 PCB A11

One SENSOR (FILM PIN) monitors if the MAGAZINE SUCKERS have reached the SUPPLY FILMS. In addition it is used to check if the FILM still sticks to the SUCKERS. The other SENSOR checks if the MAGAZINE is almost empty.

4.11 PCB A12

All signals except the AUDIBLE ALARM are just fed through.

4.12 PCB A13

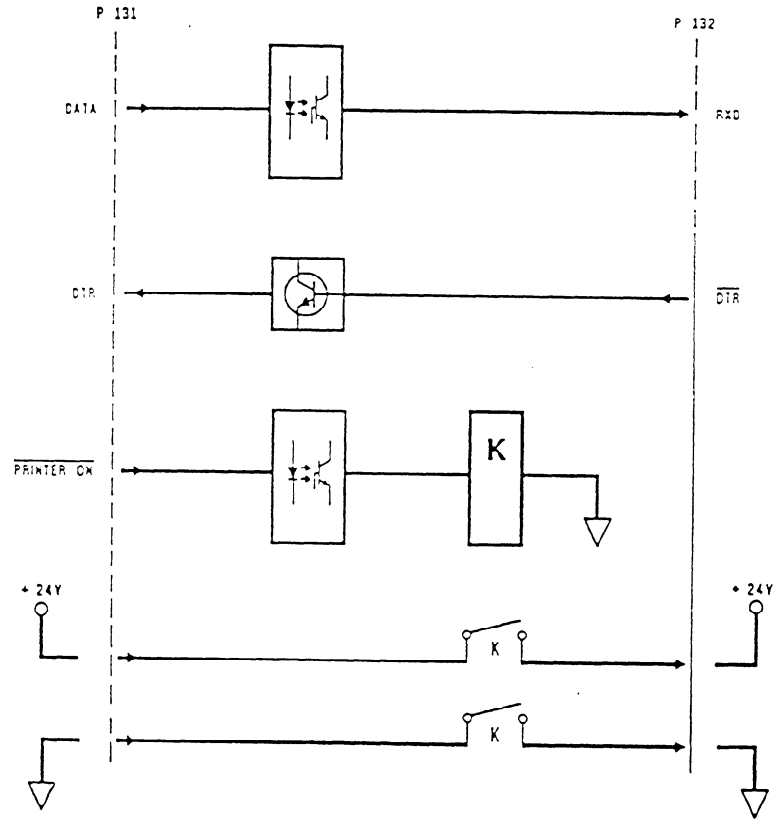

figure 14

This board is split into two parts:

1.POWER SUPPLY PART
2.DATA PART

The PRINTER is only energized if PRINTER ON is low. In this case Relay K is energized and the supply voltage is send to the PRINTER. This circuit avoids a LINE FEED if the ML 700 is powered up. As soon as the PRINTER is ready DTR goes low. This tells the MICRO PROCESSOR that it may send data. The data pulses turn on and off the OPTO COUPLER and RXD is generated.

4.13 PCB A16

This is the CONTROL PCB for the HUMIDIFIER KIT. The HUMIDITY SENSOR has linear characteristics. Its output is amplified by a factor of 10. If the r. H. is lower than 35%, the DOOR FAN is turned off and the HUMIDIFIER KIT is turned on.

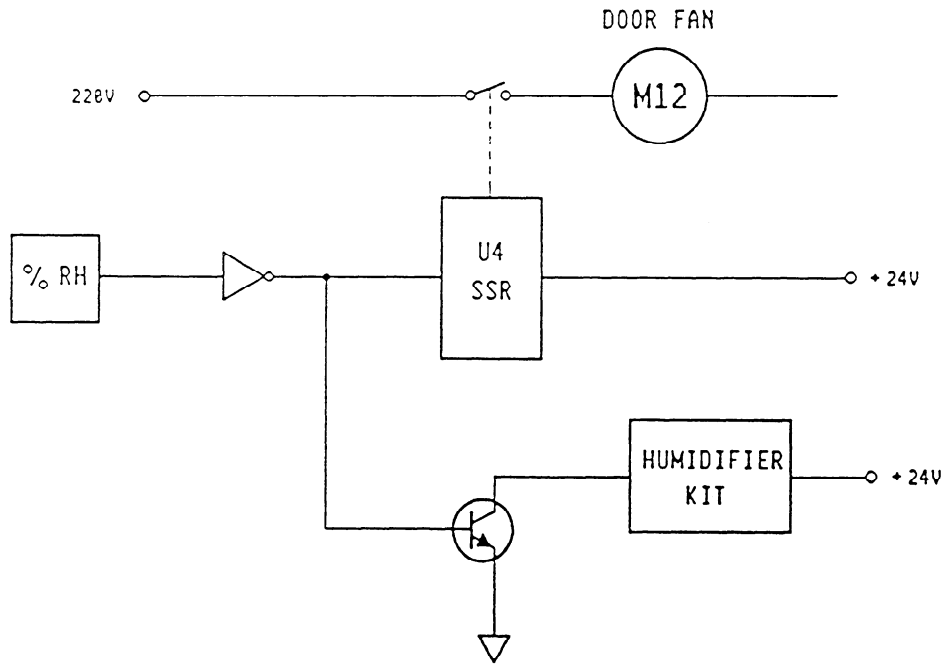

figure 15

5. FUNCTIONAL SOFTWARE DESCRIBTION

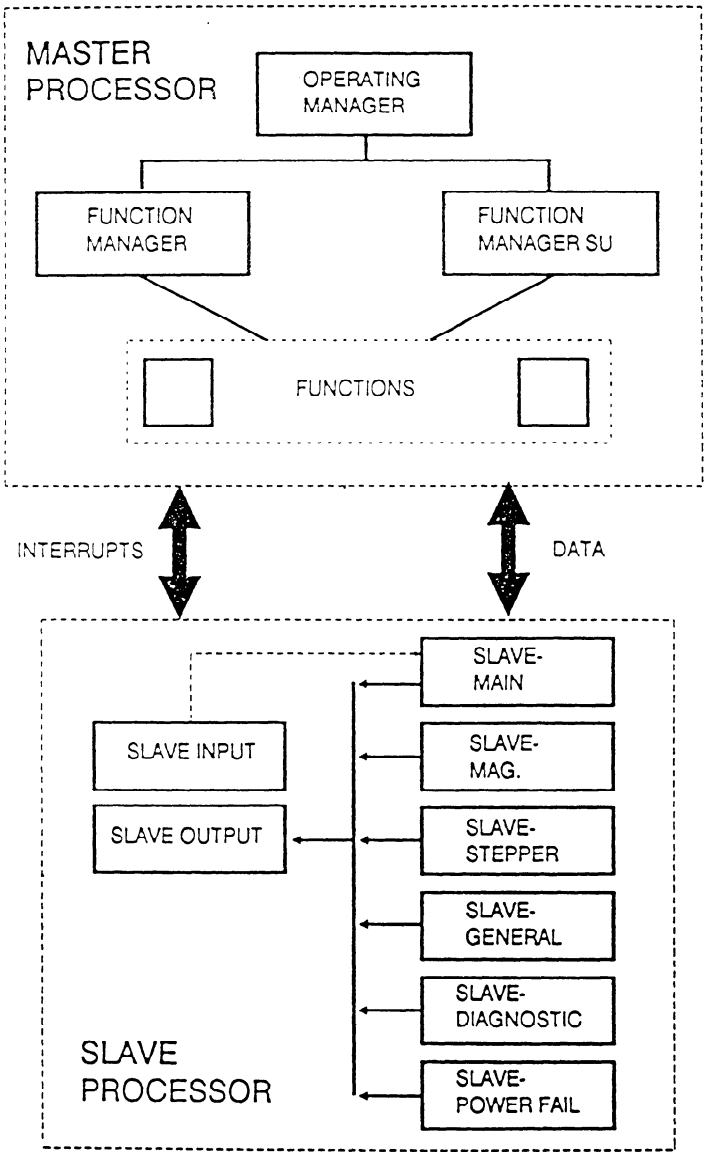

figure 16

The ML 700 operation is controlled by two Micro Processors (MASTER and SLAVE).
PCB A0 is the MASTER PROCESSOR BOARD. Fig. 15 shows the basic software structure.
The purpose of the various blocks is as follows:

Master Processor

OPERATION MANAGER

This is the operating system of the ML 700

FUNCTION MANAGER

The Function Manager starts the various Functions in the correct sequence.

FUNCTION MANAGER SU

The Function Manager starts the various Functions in the correct sequence for Serial Unload.

FUNCTIONS

The following Functions are implemented:

- CASSETTE IN
- READ CASSETTE SIZE
- OPEN CASSETTE
- FILM PRESENT DETECTOR
- UNLOAD FILM
- CASSETTE OUT

Slave Processor

SLAVE INPUT/SLAVE OUTPUT

These two modules perform communication between MASTER and SLAVE.

SLAVE MAIN

Contains

1. Mainprog. which initializes the SLAVE together with SLAVE INPUT/OUTPUT. It performs communication with the MASTER and reacts on commands from the MASTER.

2. STAT sends the SLAVE STATUS to the MASTER.

3. POWER UP routines.

SLAVE MAG

Contains MAGAZINE ROUTINES to go to the selected MAGAZINE, pick up a FILM from the MAGAZINE, DOUBLE FILM RECOGNITION, load FILM into CASSETTE, COUNTER for CASSETTE LENGTH.

SLAVE STEPPER

Contains routines to drive the STEPPERMOTOR up and down, to calculate the amount of steps between the MAGAZINE REFERENCE POSITIONS, to detect a STEPPER MOTOR COUNT ERROR, to bring the FILM POCKET to HOME POSITION, to speed up and slow down the STEPPER MOTOR.

SLAVE GENERAL

Contains timers, routines to open/close a MAGAZINE, routines to check the position of the MAGAZINE SUCKER BAR.

SLAVE DIAGNOSTIC

Contains the diagnostic routines for the SERVICE MODE.

SLAVE POWER FAIL

Contains POWER FAIL routines.

Functional Diagram

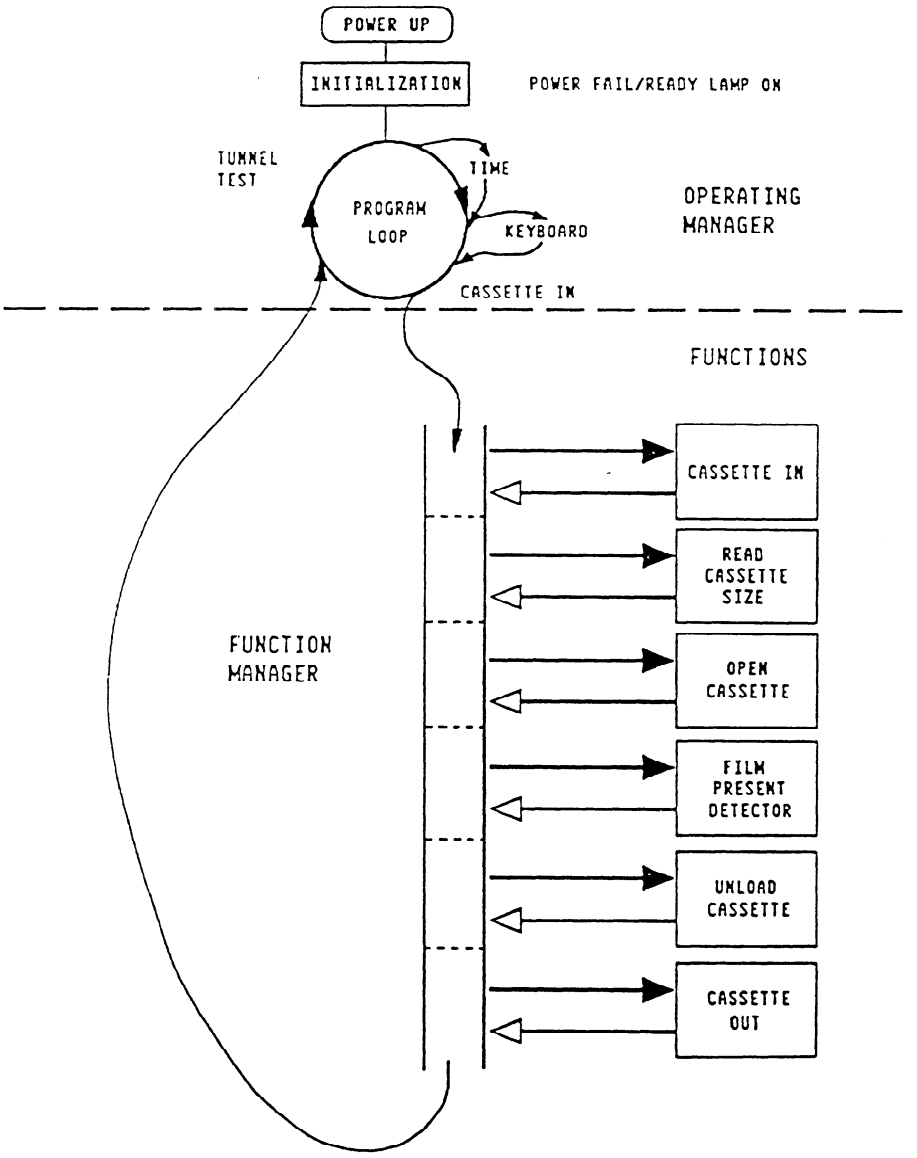

figure 17

MASTER and SLAVE are initialized after POWER UP. This means:

- Motors are stopped.

- MASTER reads status of SLAVE (Was there a POWER FAIL?), and starts movement of FILM POCKET to HOME POSITION. The MAGAZINE COVER MOTOR (M6) goes to Close POSITION. In case of a POWER FAIL the corresponding POWER FAIL ROUTINE is started and an interrupted cycle is finished.

When everything is ok the READY LAMP is turned on. Then the OPERATION MANAGER enters the PROGRAM LOOP. If a KEY is pressed the LOOP is left and the desired function (LOAD ONLY, UNLOAD ONLY, SERVICE MODE, etc.) is started.

The FUNCTION MANAGER is started as soon as a CASSETTE is inserted. The metall edge of the CASSETTE triggers the INDUCTIVE SENSORS. The FUNCTION MANAGER now calls one Function after the other. The Functions include ERROR DETECTION ROUTINES. If something goes wrong the corresponding ELAPSE TIME and ERROR FLAG is set. The ERROR HANDLING, however, is not done in the Function. This is a task of the FUNCTION MANAGER. A WARNING or ERROR MESSAGE is selected and if necessary the cycle is aborted. At the end of the cycle the CASSETTE is ejected and control is given back to the OPERATING MANAGER.

Relationship Master-Slave

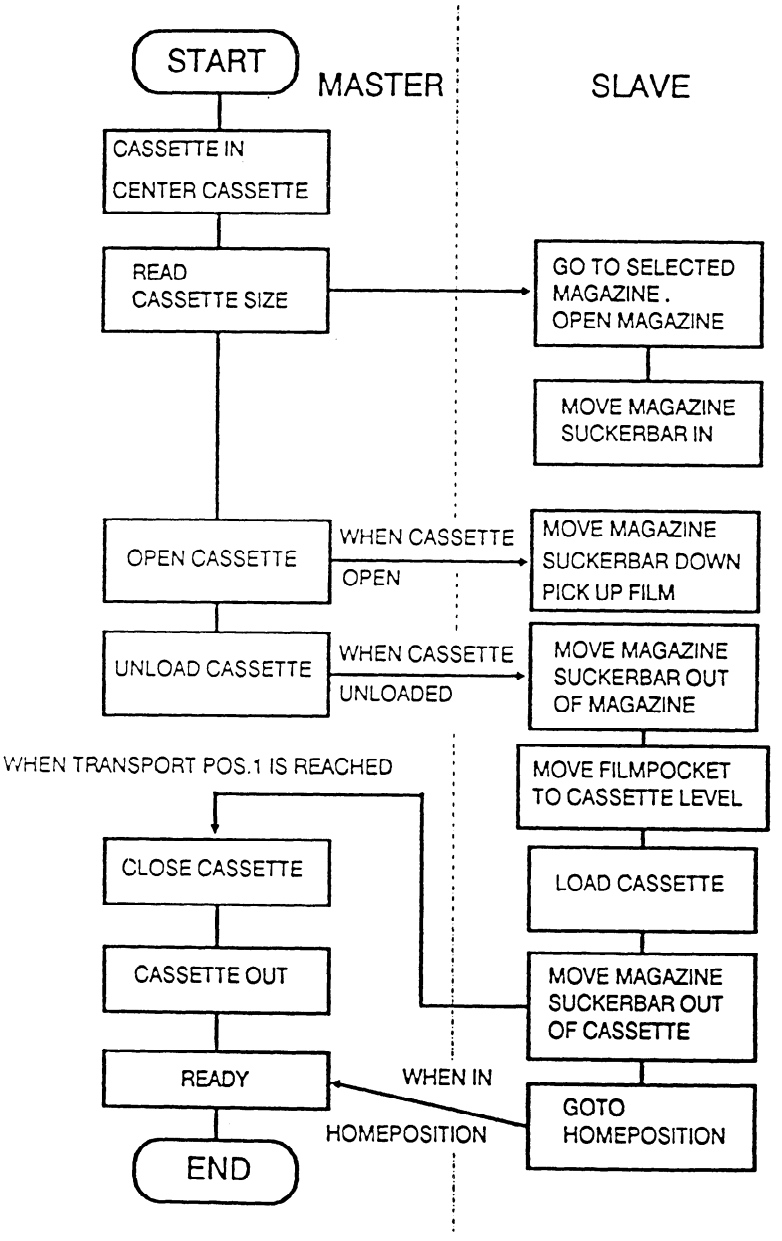

figure 18

During a cycle status and commands have to be exchanged between MASTER and SLAVE. This is done via interrupts. After the CASSETTE is centered the CASSETTE SIZE is read. This size information is send to the SLAVE. The FILM POCKET goes to the selected MAGAZINE. The MAGAZINE is opened and the MAGAZINE SUCKER BAR goes into the MAGAZINE. But no FILM is picked up at this time. When the CASSETTE is open a fresh film is picked up in the MAGAZINE, but the MAGAZINE SUCKER BAR stays in the MAGAZINE. After the CASSETTE became unloaded the MAGAZINE SUCKER BAR goes to TRANSPORT POSITION, the FILM POCKET goes to the CASSETTE LEVEL and the CASSETTE is loaded with the fresh Film. The MAGAZINE SUCKERBAR goes out of the CASSETTE. As soon as TRANSPORT POSITION 1 is reached the CASSETTE will be closed and the FILM POCKET goes into HOME POSITION. The CASSETTE is transported out. When the FILM POCKET is in HOME POSITION and the OPERATOR takes out the CASSETTE the READY LAMP is turned on again.

Film Pocket Control Normal Cycle

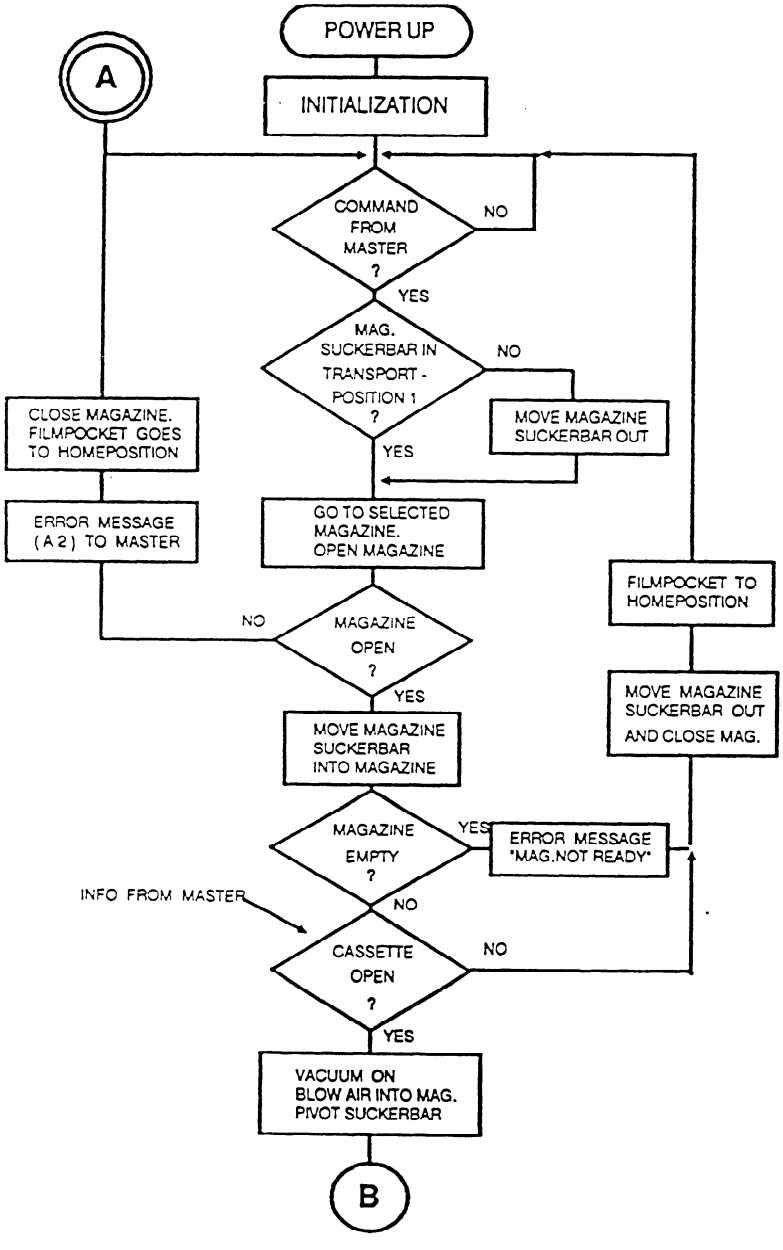

figure 19

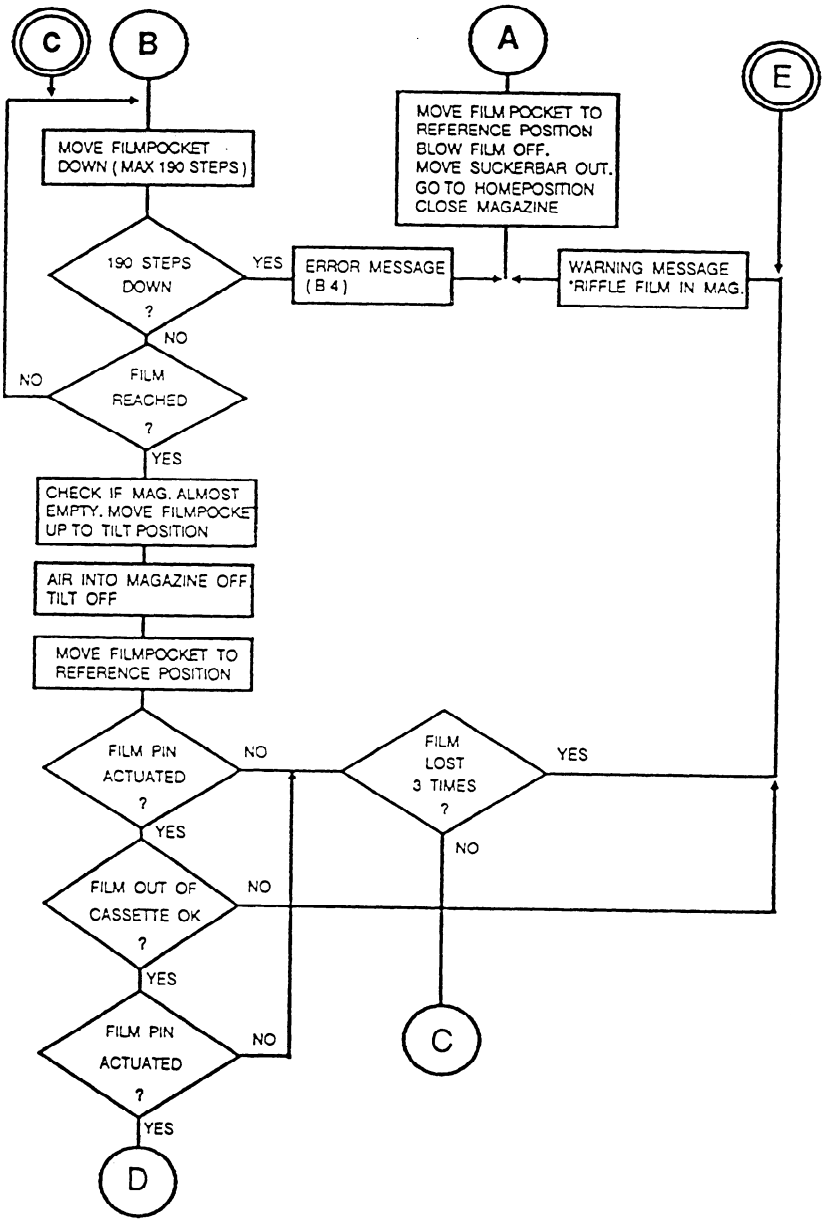
C
B
A
E
MOVE FILMPOCKET DOWN (MAX 190 STEPS)
MOVE FILM POCKET TO REFERENCE POSITION BLOW FILM OFF. MOVE SUCKERBAR OUT. GO TO HOMEPOSITION CLOSE MAGAZINE
190 STEPS DOWN ?
YES
ERROR MESSAGE (B 4)
WARNING MESSAGE *RIFFLE FILM IN MAG.
NO
NO
FILM REACHED ?
YES
CHECK IF MAG. ALMOST EMPTY. MOVE FILMPOCKET UP TO TILT POSITION
AIR INTO MAGAZINE OFF TILT OFF
MOVE FILMPOCKET TO REFERENCE POSITION
FILM PIN ACTUATED ?
NO
FILM LOST 3 TIMES ?
YES
YES
NO
FILM OUT OF CASSETTE OK ?
NO
YES
FILM PIN ACTUATED ?
NO
C
YES
D

figure 20

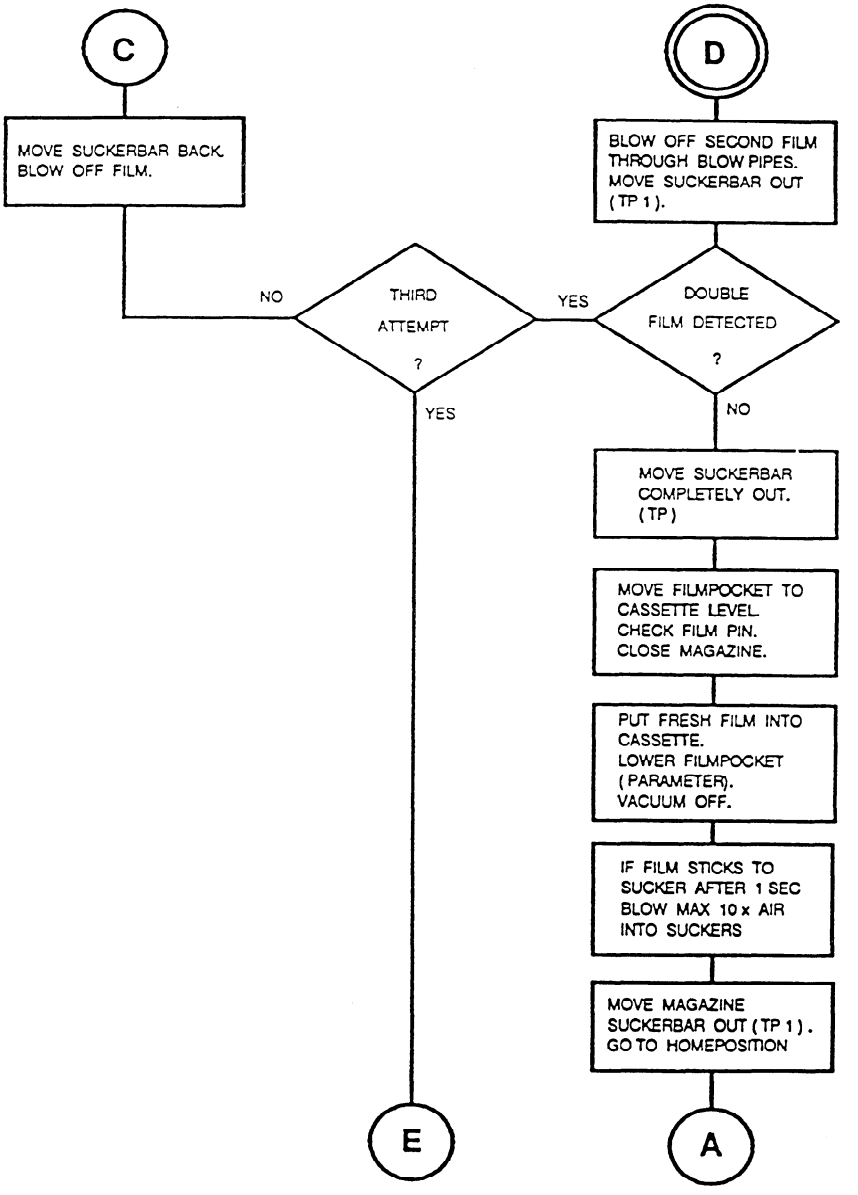
C
MOVE SUCKERBAR BACK.
BLOW OFF FILM.
NO
THIRD ATTEMPT ?
YES
E
D
BLOW OFF SECOND FILM THROUGH BLOW PIPES.
MOVE SUCKERBAR OUT (TP 1).
DOUBLE FILM DETECTED ?
YES
NO
MOVE SUCKERBAR COMPLETELY OUT. (TP)
MOVE FILMPOCKET TO CASSETTE LEVEL.
CHECK FILM PIN.
CLOSE MAGAZINE.
PUT FRESH FILM INTO CASSETTE.
LOWER FILMPOCKET (PARAMETER).
VACUUM OFF.
IF FILM STICKS TO SUCKER AFTER 1 SEC BLOW MAX 10 x AIR INTO SUCKERS
MOVE MAGAZINE SUCKERBAR OUT (TP 1).
GO TO HOMEPOSITION
A

figure 21

6. NORMAL SEQUENCE

6.1 Cassette Entry:

1.ENTRY DOOR is open, PRESSURE ROLLERS are down, READY LAMP is on.

2.CASSETTE inserted, LATCH UP and leading.

3.INDUCTIVE SENSORS detect metal, starts BELT, switches READY LAMP off, and turns BUSY LAMP on.

4.CASSETTE pushed to nib of PRESSURE ROLLERS and BELT.

5.Belt pulls CASSETTE forward, which raises ROLLERS.

6.Raising of ROLLERS STARTS timing mechanism.

7.When timing is completed, then SHAFT rotates to lift PRESSURE ROLLERS (providing clearance for CENTERING BARS and CASSETTE).

8.BELT carries CASSETTE to the end stop, turns the CASSETTE to bring the LATCH edge perpendicular to the direction of travel (should one corner of the CASSETTE reach the end stop ahead of the other), actuating the END SWITCH, which:

a)turns off the DRIVE BELT, and

b)starts CENTERING BARS moving toward CENTER. (Note: If for any reason the CENTERING BARS are not in the outer position, they will first move outward to the outer position before moving toward the center.)

9.CENTERING BARS moving in to push CASSETTE to center, squeeze it briefly, and back off 1 to 2 mm from each end of the CASSETTE. (Note: An override SWITCH prevents the SIDE BARS from going too far, in the event of misuse or the insertion of a too small cassette (e.g., 13 x 18 cm)).

10.If the END SWITCH is released during the centering operation, the BELT restarts to drive the CASSETTE back to the end stop.

11.A SENSOR CS (B1) determines the nominal lenght of the CASSETTE from the position of the CENTERING BARS when stopped.

12.The position of two LEVERS, in conjunction with the measured length, determines the nominal size of cassette, thereby establishing the size of FILM to be selected.

13.The Type II SENSOR is actuated to determine FILM TYPE to be selected (if not Type II, the Type I by default).

14.With FILM SIZE and TYPE selected, the system logic:

a)starts opening the cover of the selected MAGAZINE,

b)starts the FILM POCKET to the selected MAGAZINE (FILM REMOVAL ACTION is not started, however, until the CASSETTE and the selected MAGAZINE are confirmed open), and

c)starts CASSETTE OPENING CYCLE (15-25)

6.2 Cassette Opening

15. ENTRY DOOR closes.

16. CASSETTE latch is relaxed by pressure from SPRING LOADED PINS pushing on rail on either side of LATCH.

17. The SHOVEL slides under loosened LATCH, unlatching cassette.

18. FILM EXIT DOOR, to which SPRING LOADED pins are attached, is raised.

19. CASSETTE is started open by natural spring action assisted by two spring loaded arms attached to the exit door (required for VIDEO FILM HOLDERS, and most 18 x 24 cm CASSETTES).

20. PAWL HOOK make positive engagement with the cover (LATCH SIDE PANEL).

21. The CASSETTE HOLD-DOWN PAWL engages TUBE SIDE PANEL to prevent lifting of tube side while the CASSETTE COVER is raised or while the FILM is taken by the SUCKER BAR. On FILM HOLDERS, only one side is held down.

22. S1(CO) SENSOR determines if the CASSETTE opened.

23. If the CASSETTE and the selected MAGAZINE are both confirmed open, new FILM pick up is initiated to the point of picking up the new FILM, but not removing it from the MAGAZINE.

24. The FILM PRESENT DETECTOR "looks" for a FILM:

a) If FILM is sensed on UPPER SCREEN the SYSTEM fires a short burst of air, "looks" again, and - if FILM is still on UPPER SCREEN - repeats this procedure up to a total of 5 cycles. If still not successful, the SYSTEM closes the CASSETTE and returns it with a WARNING MESSAGE.

b) If no FILM is sensed, the SYSTEM by-passes the FILM REMOVAL CYCLE, treats this CASSETTE as a "load only" CASSETTE, and presents WARNING MESSAGE.

c) If FILM is sensed on both screens, the SYSTEM initiates an "UNLOAD ONLY" operation and returns the CASSETTE with a WARNING MESSAGE (if there was actually two FILMS in the CASSETTE, the second FILM could be removed by reinserting the CASSETTE rather than going to the darkroom).

d) If FILM is sensed on the BOTTOM SCREEN, the SYSTEM starts the normal FILM REMOVAL CYCLE (25-34).

6.3 Cassette Film Removal

25 .SYSTEM senses if tunnel is clear. If not, and if not clear in 30 seconds, the CASSETTE is returned with a WARNING MESSAGE.

26. CASSETTE SUCKER BAR is inserted into the CASSETTE.

27. VACUUM is turned on.

28. SUCKER BAR is lowered to contact film with extended SUCKERS.

29. SUCKERS retract under VACUUM, lifting leading edge of FILM from SCREEN.

30. The SUCKER BAR is moved out of cassette to engage FILM in the nib of the transfer rollers (CASSETTE is being held down by CASSETTE HOLD-DOWN PAWLS, see step 21), and

31. The leading edge of the FILM interrupts the SENSOR FOC (B6) and initiates the VACUUM OFF TIMING. (If interruption does not occur in set time the cycle of steps 26 through 30 will be repeated to a maximum of 3 complete cycles. If no FILM is sensed after 3 attempts, the CASSETTE is closed and returned with a WARNING MESSAGE.)

32. As FILM engages ROLLER NIB, VACUUM RELEASE is completed and SUCKER BAR raised away from the FILM to its ready position.

33. FILM is driven by TRANSFER ROLLERS to the TUNNEL (and through the TUNNEL to the PROCESSOR).

34. After detecting that the TRAILING EDGE of the exposed FILM has left the CASSETTE, the new FILM LOADING CYCLE is continued (35-44) and the PROCESSOR started.

6.4 New Film Loading

35. The new FILM is picked up from the STACK in the MAGAZINE:

a) MAGAZINE SUCKER BAR is entered into MAGAZINE.

b) BLOW PIPES are actuated to separate sheets.

c) VACUUM to SUCKERS is actuated.

e) The STEPPER MOTOR lowers the SUCKER BAR until the top sheet is sensed, grip the top sheet which is floating on a layer of air.

f) SUCKER BAR with FILM is raised to TILT POSITION.

g) SUCKER BAR is tilted back and BLOW PIPES SWITCHED off.

h) Pause for FILM SEPARATION.

i) SUCKER BAR is raised to REFERENCE POSITION.

36. After confirming that the TRAILING EDGE of the exposed FILM has left the CASSETTE (step 34), the SUCKER BAR withdraws from the MAGAZINE to pass the FILM through the DOUBLE SHEET DETECTOR:

a) If no FILM is detected, the SYSTEM recycles twice (total of three attempts) before delivering a TROUBLE MESSAGE.

b) If more than one sheet is detected, the SYSTEM returns the films to the MAGAZINE, with the BLOW PIPES acting as pushers for sheets fallen loose in the process.

c) If one and only one sheet is detected, the SUCKER BAR continues to move the sheet into the FILM POCKET.

37. When the TRANSPORT POSITION is reached, the movement of the SUCKER BAR is stopped, and the POCKET is started up to the CASSETTE LEVEL.

38. The MAGAZINE COVER is closed.

39. When the POCKET reaches the CASSETTE LEVEL, the ELEVATOR stops.

40. The SUCKER BAR is advanced into the open CASSETTE.

41. If a VIDEO FILM HOLDER is to be loaded, the SUCKER BAR is rotated to the horizontal position (due to wider frame).

42. The VACUUM is released and positive air pressure is switched to the SUCKERS.

43. When the "FILM PIN" is released:

    a) the air pressure is turned off,

    b) the FILM falls into the CASSETTE or FILM HOLDER, and

    c) the SUCKER BAR is withdrawn from the CASSETTE.

44. When the SUCKER BAR reaches TRANSPORT POSITION 1

    a) The FILM POCKET is returned to its HOME POSITION opposite MAGAZINE NO. 4 and

    b) the CASSETTE OUT Function is initiated (45-53).

6.5 Cassette Exit

45. The CASSETTE LID lowers together with the PAWL HOOK EXIT DOOR.

46.The PAWL HOOK is disengaged.

47 .The EXIT DOOR is lowered to closed position and the SPRING LOADED PINS push on the rail to close the CASSETTE.

48. The SHOVEL is returned from under the LATCH (the CASSETTE is now closed and latched).

49. The CAM SHAFT rotates to middle position:

a) the ENTRANCE DOOR is lifted about 3 mm for CASSETTE clearance,

b) the SHOVEL and PAWL HOOK are lifted,

c) the PRESSURE ROLLERS are moved to the DOWN POSITION,

d) the TRANSPORT BELT starts moving outward, and

e) the CENTERING BARS start moving outward to HOME POSITION.

50. The CASSETTE moving outward raises PRESSURE ROLLERS and rotates the CAM SHAFT to its END POSITION, lifting PRESSURE ROLLERS.

51. When timing is completed, the BELT stops with the CASSETTE HINGE EDGE extended about 6 cm (2-1/2 in), waiting for the OPERATOR.

52. Removal of the CASSETTE passes the RAIL under the INDUCTION SENSORS which starts the CAM SHAFT rotating to the HOME (middle) POSITION and lowers the PRESSURE ROLLERS.

53. The BUSY LAMP is turned off, the READY LAMP on, and the SYSTEM is ready for another CASSETTE.

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